US Army Corps of Engineers®

Ice Engineering

U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire

Ice Jams, Winter 1997–98

Rivers, streams, and lakes in cold regions freeze during winter months. Ice jams may form during initial ice cover formation (freezeup jams) or when ice cover breaks up (breakup jams). Both freezeup and breakup jams cause backwater flooding and damage to low-lying areas and municipal structures (Fig. 1).

Costly damages to riverine communities are a direct result of these ice jams, which often leave little time for engineers and state officials to prepare for flooding and to evacuate communities or structures that may be affected by rapidly rising waters. Ice jams can cause an estimated $100 million in damages annually in the United States. Roads may be flooded and closed, or bridges weakened or destroyed, limiting emergency and medical relief to the affected areas. The potential exists for death or serious injury caused by jam and flood conditions, and during evacuations and other ice mitigation operations. Also, ice movement and ice jams can severely erode streambeds and banks, with adverse effects on fish and wildlife habitat.

Engineers and state officials work together to prevent damages caused by ice jams, and many are working to anticipate future measures to prevent serious ice jams from forming. These efforts depend upon accurate and reliable ice jam data. The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Jam Database is a compilation of freezeup and breakup ice jam events in the United States (White 1996). Currently, there are 11,470 entries in the database, dating from 1780. CRREL's Ice Jam Database is a reliable resource used to research previous ice jams and to predict and assess conditions that may increase the probability of an ice jam formation. The database is also used to document steps taken by engineers and relief officials in previous years when confronted with ice jam conditions during emergency situations.

Figure 1. USGS gage house destroyed by ice at Dickey, Maine.

This issue provides a brief summary of ice jam data for water year 1998 (1 October 1997 through 30 September 1998) using information collected in the CRREL Ice Jam Database. Currently, there are 57 ice jam entries in the database for water year 1998 (Fig. 2). Most of these were retrieved from daily bulletins and reports detailing field conditions observed by the National Weather Service (NWS). CRREL and other Corps personnel also provided data. Of the 1998 ice jam events, 33% have some reported damages, mostly lowland and road flooding.

When and where did the 1998 ice jams occur?

The highest percentage of the 1998 ice jams occurred in January (40%), followed by 28% in March (Fig. 3). During the first two weeks of January, heavy rain and melting snow contributed to the ice, followed by eight ice jams in Vermont and seven in Maine. New York reported six ice jams for water year 1998, and Wisconsin reported 10 (Fig. 4). The majority of ice jams that

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Abstract

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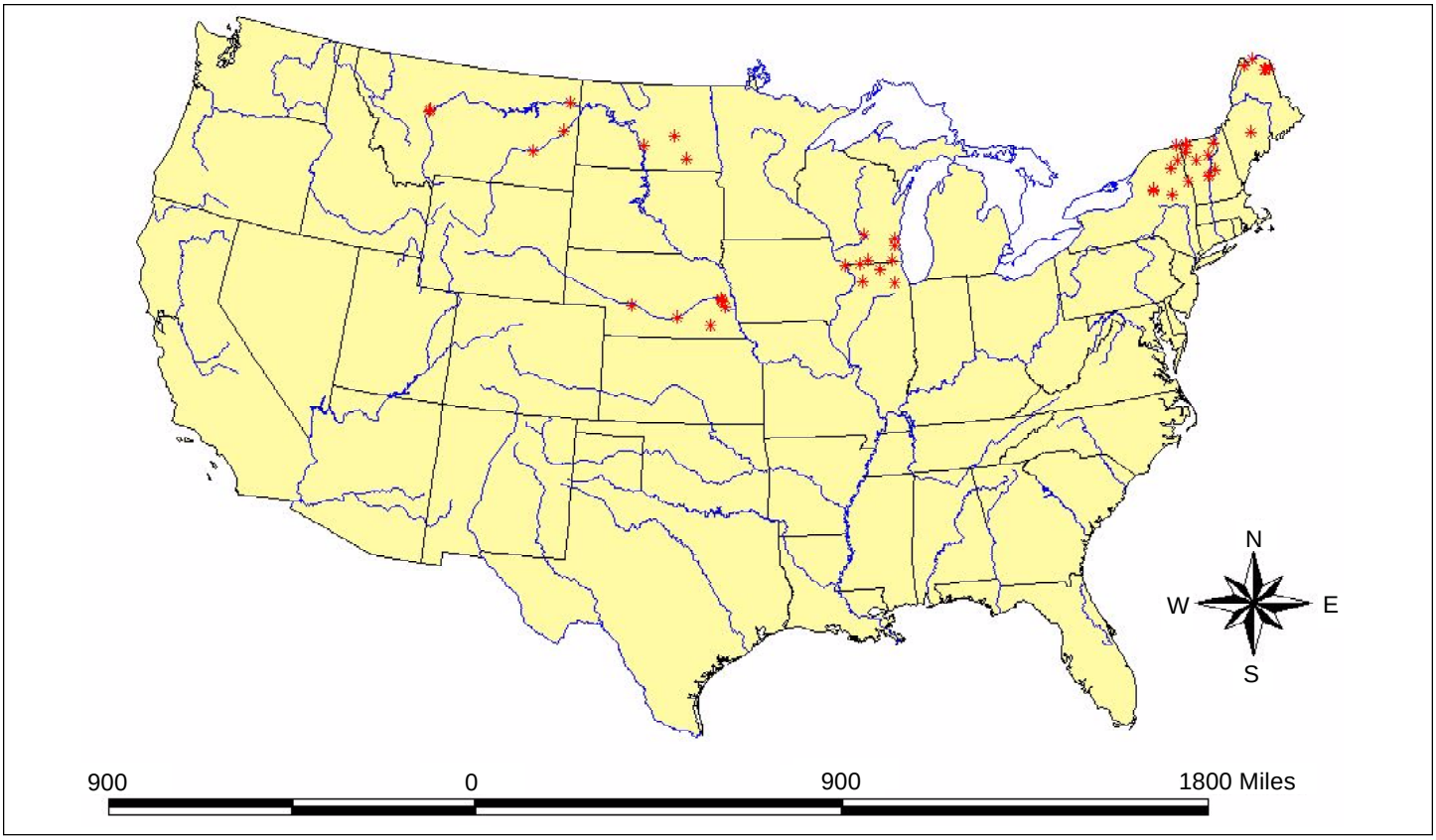

Figure 2. 1998 ice jams.

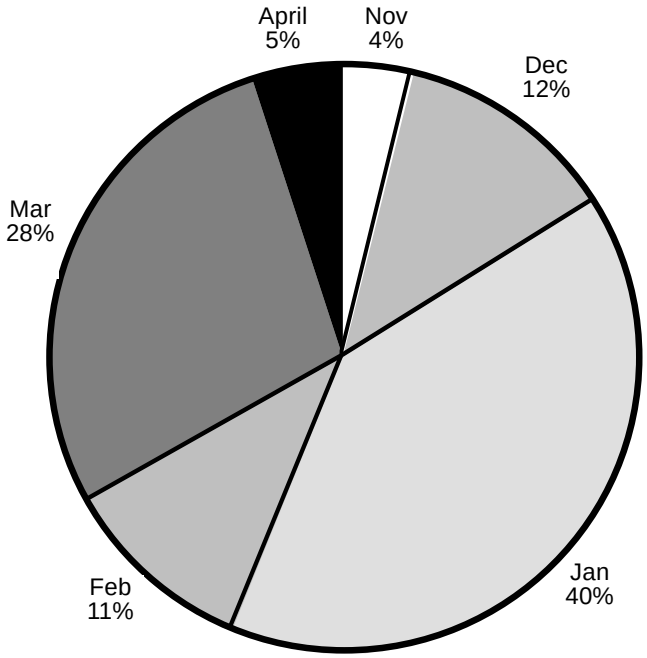

Figure 3. Number of ice jams per month for water year 1998.

took place in water year 1998 occurred in Nebraska (see "Nebraska's ice jams," next page).

In late March and early April, the Aroostook River in Maine jammed with ice because of spring breakup. At Crouseville on 2 April the ice jammed and caused Highway 164 to close for three days. Eventually the water found a way around the ice, and lowland and road flooding stopped. The ice jam at Fort Fairfield caused water to back up and flood Main Street, thereby causing alarm. Russel Road also was closed. The town hired an Amphibex, which is part barge, part boat, and part excavator, to help break up the ice jam, and operators at Tinker Dam increased and decreased the flow to see if they could help break it up. The jam moved slightly, either because of these efforts or the warm temperatures, and the water levels dropped, allowing both roads to open. Elsewhere in Maine, the Piscataquis, Kennebec, and St. John Rivers jammed, causing rapid river rises and minor lowland flooding.

In Vermont three minor ice jams occurred in January, causing rapid rises on the Winooski, White, and Passumpsic Rivers. In March ice on the Missisquoi River jammed, causing road flooding in East Highgate and Sheldon.

In New York four minor ice jams also occurred in January. Combined with rain, these ice jams caused rapid rises on the Sacandaga, Moose, and

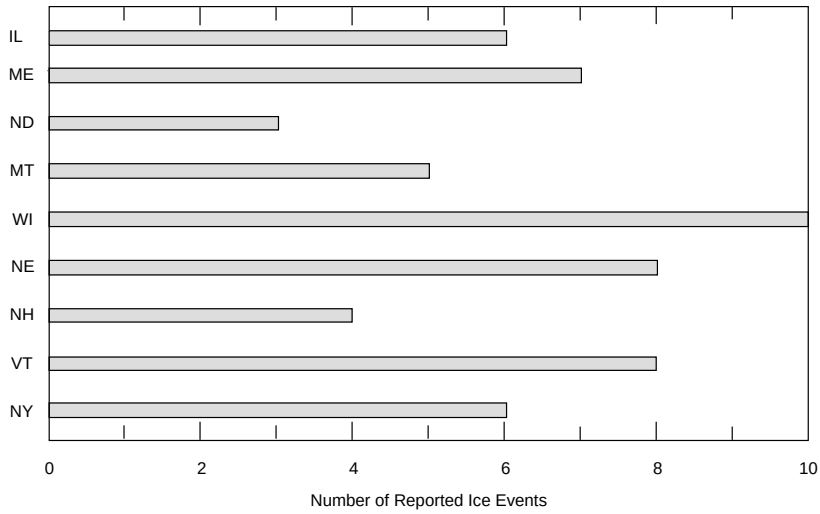

Figure 4. Number of ice jams per state for water year 1998.

Ausable Rivers. In March, an ice jam caused lowland flooding on the Great Chazy River.

Nebraska's ice jams

Eighty-eight percent of Nebraska's ice jams occurred along the Platte River (Fig. 5). The town of Fremont was affected when a two- to three-mile-long jam formed upstream of the Highway 77 bridge in January. This jam was considerably alarming as it caused flooding of a local road, park, and YMCA camp. Cold weather encouraged ice jam growth, until finally warmer temperatures eroded the ice.

During March 1998 more ice jams affected the towns along the Platte River. On 16 March, Papio-Missouri River Natural Resources District employees flew over the Platte River from Fremont downstream to Interstate 80 to verify the presence of two ice jams. A one-and-a-half-mile-long ice jam was located in the vicinity of the Union Dike/Woodcliff housing area near the Douglas/Dodge county line, and a half-mile-long jam was located near Vencil's Island, approximately two miles north of the Platte/Elkhorn confluence. These jams caused lowland flooding in Fremont, Woodcliff, and Lamoure and came within two feet of overtopping the Union Dike/Woodcliff housing area in Saunders County and cut off access to Vencil's Island. The Papio-Missouri River Natural Resources District decided to use explosives to blast through the ice jams to allow backed-up water and ice to move downstream to relieve the lowland flooding problems (Petermann 1998).

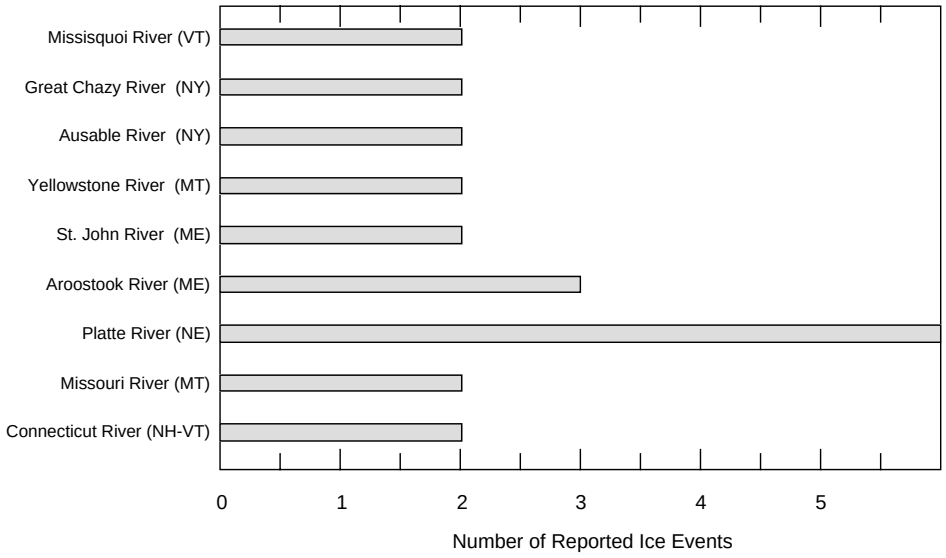

Figure 5. Number of ice jams per river having two or more ice jams in water year 1998.

Blasting began on the morning of 18 March 1998. The charges consisted of a stick of dynamite, some ammonium nitrate, and a two-minute fuse, which were all placed into a sandbag. The crews loaded the charges in a helicopter and flew over the jam. When they were near the edge of the jam, they threw two or three lighted charges onto the ice. It took three hours to drop 148 charges of dynamite on the ice jam in the Union Dike/Woodcliff housing area, resulting in a 200-foot open channel and an immediate drop in water level. It took an hour and a half to drop about half as many charges along the half-mile-long ice jam near Vencil's Island. Within 45 minutes after blasting, the water had begun to recede from the road that leads to the island (Rosman 1998a).

The approximate cost of the ice jam removal contract, including helicopter and pilot, explosives contractor, and explosives material was $25,000. It took three days of work by bulldozers and trucks to repair a 40-foot-wide, 15-foot-deep hole created by ice jam flooding in the Platte River levee near Vencil's Island. These ice jams destroyed several mobile homes and recreational vehicles, washed out a town road three miles south of the Douglas/Sarpy county line, and flooded a golf course (Rosman 1998b).

Corps response

In 1998, the U.S. Army Corps of Engineers provided technical, financial, and mechanical resources to communities affected by ice jams and subsequent flooding. CRREL provided recommendations, referrals, on-site observations, and points of contact to the Corps of Engineers New England Division and the Districts of Chicago and Omaha:

- Sand bags were deployed at Wood River, Nebraska, and at Platte River.
- Assistance was provided by

Scott Acone to Fort Fairfield, Maine.
- Blasting charges were used to break up jams on the Platte River.

How is this information helpful?

This overview of 1998 ice jams is the third in an annual series of reports on ice jam summaries. Each water year, the Ice Jam Database and Ice Jam Archive are updated to provide the most current accessible literature and data concerning ice jams. The historical data found in the Ice Jam Database are crucial in emergency situations when information about river gage stations or previous jam locations is necessary for the prevention or alleviation of ice jam hazards.

In particular, weather conditions surrounding ice jams can be the most important factor when predicting ice jam formation conditions. If the meteorological and hydrological conditions surrounding previous ice jams are known at certain river locations, it may be possible to predict or even prevent ice jam formation, and to prepare a community for its impact.

CRREL's Ice Jam Archive can be used as a source of historical data as it is a collection of hard copies of data and summary information used in this report and for previous water years. These resources include NWS reports, newspaper articles, and other reports, which can be photocopied or checked out for research purposes.

References

Petermann, M.J. (1998) Unpublished memorandum for Papio-Missouri River Natural Resources District files, 16 April 1998.

Rosman, V. (1998a) Crews break up Platte ice with 205 blasts of dynamite. *Omaha World Leader*, Omaha, Nebraska, 19 March 1998.

Rosman, V. (1998b) It's been no picnic. *Omaha World Leader*, Omaha, Nebraska, 24 March 1998.

White, K.D. (1996) A new Ice Jam Database. *Water Resources Bulletin*, **32**(2): 341–348.

Acknowledgments

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Please send any information for inclusion in the Ice Jam Database or Ice Jam Archive to Lourie Herrin, Ice Engineering Research Division, CRREL, 72 Lyme Road, Hanover, New Hampshire 03755-1290. Originals can be photocopied or scanned and returned.

The CRREL Ice Jam Database is available via CRREL's Web site (http://www.crrel.usace.army.mil/).

This issue of the Ice Engineering Information Exchange Bulletin *was written by Lourie A. Herrin, Research Program Assistant; Heidi Eames, Engineering Aid; and Kate White, Research Hydraulic Engineer, of CRREL's Ice Engineering Research Division, and was edited by Gioia G. Cattabriga and laid out by John D. Severance of CRREL's Technical Information Branch. John J. Gagnon, Civil Engineering Technician, IERD, prepared the Web pages for this issue.*

Ice Engineering Information Exchange Bulletin

The *Ice Engineering Information Exchange Bulletin* is published in accordance with AR 25-30 as one of the information exchange functions of the Corps of Engineers. It is primarily intended to be a forum whereby information on ice engineering work done or managed by Corps field offices can be disseminated to other Corps offices, other U.S. Government agencies, and the engineering community in general. The purpose of the *Ice Engineering Information Exchange Bulletin* is information exchange and not the promulgation of Corps policy; thus, guidance on recommended practice in any given area should be sought through appropriate channels or in other documents. This bulletin's contents are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

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Communications are welcomed. Write to CRREL, ATTN: J.-C. Tatinclaux (CEERD-RI), 72 Lyme Road, Hanover, NH 03755-1290, or call 603-646-4361.